

Nemani  
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### **Observed trend in surface wind speed over the conterminous USA and CMIP5 simulations**

There has been no spatial surface wind map even over the conterminous USA due to the difficulty of spatial interpolation of wind field. As a result, the reanalysis data were often used to analyze the statistics of spatial pattern in surface wind speed. Unfortunately, no consistent trend in wind field was found among the available reanalysis data, and that obstructed the further analysis or projection of spatial pattern of wind speed. In this study, we developed the methodology to interpolate the observed wind speed data at weather stations using random forest algorithm. We produced the 1-km daily climate variables over the conterminous USA from 1979 to 2015. The validation using Ameriflux daily data showed that  $R^2$  is 0.59.

Existing studies have found the negative trend over the Eastern US, and our study also showed same results. However, our new datasets also revealed the significant increasing trend over the southwest US especially from April to June. The trend in the southwestern US represented change or seasonal shift in North American Monsoon. Global analysis of CMIP5 data projected the decrease trend in mid-latitude, while increase trend in tropical region over the land. Most likely because of the low resolution in GCM, CMIP5 data failed to simulate the increase trend in the southwest US, even though it was qualitatively predicted that pole ward shift of anticyclone help the North American Monsoon.

#### **Authors**

Hirofumi Hashimoto  
[hirofumi.hashimoto-1@nasa.gov](mailto:hirofumi.hashimoto-1@nasa.gov)

- California State University Monterey Bay

Ramakrishna R Nemani  
[rama.nemani@nasa.gov](mailto:rama.nemani@nasa.gov)

- NASA Ames Research Center